



# EXCERPT FROM THE PROCEEDINGS

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## OF THE FIFTH ANNUAL ACQUISITION RESEARCH SYMPOSIUM

**RETHINKING ACQUISITION REFORM: COST-GROWTH SOLUTIONS  
MAY AGGRAVATE MORE IMPORTANT PROBLEMS**

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**by**

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## Proceedings of the Annual Acquisition Research Program

The following article is taken as an excerpt from the proceedings of the annual Acquisition Research Program. This annual event showcases the research projects funded through the Acquisition Research Program at the Graduate School of Business and Public Policy at the Naval Postgraduate School. Featuring keynote speakers, plenary panels, multiple panel sessions, a student research poster show and social events, the Annual Acquisition Research Symposium offers a candid environment where high-ranking Department of Defense (DoD) officials, industry officials, accomplished faculty and military students are encouraged to collaborate on finding applicable solutions to the challenges facing acquisition policies and processes within the DoD today. By jointly and publicly questioning the norms of industry and academia, the resulting research benefits from myriad perspectives and collaborations which can identify better solutions and practices in acquisition, contract, financial, logistics and program management.

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# Rethinking Acquisition Reform: Cost-growth Solutions May Aggravate More Important Problems

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**Presenter: Phil Candreva**, MS, Senior Lecturer of Budgeting, Graduate School of Business and Public Policy, NPS. Candreva's research investigates how government organizations use financial information in such areas as resource allocation decision-making, accounting, performance measurement, and management reform. Most contemporary public sector management reform efforts are either explicitly tied to financial decisions (e.g., performance-based budgeting) or are implicitly tied through other management efforts (e.g., efficiency programs). Since budgets are the battlefield on which public policy disputes are waged, public managers must become proficient at showing how effectively and efficiently those resources are being used in order to preserve or expand their resource base. Such efforts are a critical dimension of contemporary management reform.

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## Abstract

There is increasing dissatisfaction with cost growth in major defense acquisition programs. Cost growth crowds out other investments, stresses budgets or causes schedule slips, all of which result in a military force that is less capable than previously expected. Several recent studies have recommended two categories of reforms: capital budgeting reforms seek stability in acquisition accounts, and rational cost model reforms seek to reduce the percentage increase of final cost over budget estimates. In both categories, undesirable secondary effects may be worse than the desirable primary effects; specifically, reforms that reduce cost growth may do so by driving total costs higher. This study examines these reforms and discusses their secondary effects. The paper concludes that the current practice of generating low estimates, coupled with dissatisfaction with cost growth may best serve to limit total cost.

## Introduction

Cost growth in defense acquisition programs is a problem that captures the attention of the general public, the media, Congress, defense reformers, and the acquisition community. Cost growth is said to reduce the affordability of the long-term defense program, resulting in top-line budget increases, reduced or late programs, or a combination of the two. Despite over a decade of growing defense budgets (even when one excludes the burden and cost of GWOT borne outside the regular budget process), service chiefs feel increasingly constricted in their procurement accounts. From 2001 to 2007, the planned investment in new programs doubled—from a portfolio valued at approximately \$750 billion to almost \$1.5 trillion (GAO, 2007, March, p. 3). Cost growth is a persistent and perhaps intractable problem:

- *Historical performance has not been good.* The GAO has included defense acquisition management among its High Risk programs since the list began in 1990, in part due to



cost management. “Weapons systems routinely take much longer to field, cost more to buy, and require more support than provided for in investment plans” (GAO, 2007, January, p. 61). The GAO’s review of 27 weapons systems showed total cost growth of 19%, RDT&E growth of over 33% and schedule slippages of 23% (GAO 2007, March, p. 9). Looking back over the last three decades, RAND has shown that cost growth has averaged about 46%—that is, programs actually cost 46% more than estimated at Milestone B—and that cost performance has not improved despite numerous and continuous acquisition reform efforts (Younossi et al., 2007).

- *The problem is expected to continue into the future.* Using historical performance as a predictor of future needs, the CBO projects that the investment accounts in the FYDP are underfunded by about 28% (CBO, 2007, p. 14).

- *The phenomena are well-understood and documented.* The *Defense Acquisition Performance Assessment (DAPA)* report stated:

Over many years, 128 studies have been done to address perceived problems with the system and to prevent waste, fraud and abuse. Historically, we observed that cost and schedule instability have been a problem in all system acquisitions since the Civil War. We see some of the same issues as problems today that the Packard Commission saw 20 years ago. (Kadish et al., 2006, p. 2)

- *The critics and ideas are not all external to the Department.* The DoD’s own *Acquisition Transformation Report* to Congress lists seven implementation goals. Three include the term “cost-effective” in their title, and a fourth relates to governance and decision processes (Kreig, 2007, p. 6). It is not that DoD is turning a deaf ear; the intentions are all good.

There is no shortage of recommendations and plans to fix the problems of cost growth. Defense contractors, advisory bodies, and R&D centers have spent vast sums over the years chronicling such problems and offering solutions. Ninety (42%) of the 212 defense management reform initiatives in the period 1990-2006 dealt with acquisition and budgeting (Francis & Walther, 2006). The study of reform agendas and recommendations is an exercise in organizational evolution. Just as Darwin noted the beaks of the finches on the Galapagos Islands adapted gradually to their environments, recommendations to fix acquisition evolve slightly from report to report. This article takes a radically different tack—a leap on the reform recommendation evolutionary path, if you will. This article will argue that the cost-growth phenomenon may not even be a problem. It probably is less of a problem than the proffered solutions. In fact, if we assume DoD policies and procedures have evolved purposefully with competent managers in light of the available knowledge, then the current system may be the best available to ensure programs are delivered at the lowest cost. Attributes of some of the solutions to cost growth may actually drive total costs higher.

Those who study defense acquisition point to several problems associated with cost growth. One set of problems is related to the decision whether to invest. Underestimation “leads to poor investment choices” by starting more or larger programs than the department can afford (Melese, Franck, Angelis & Dillard, 2007, p. 358). If there is a business rule that a certain cost-benefit ratio threshold must be exceeded to make the initial investment, then an underestimate of cost may cause those making resource allocation decisions to err. Similarly, in an analysis of alternatives, if the cost estimates are not uniformly inaccurate, resource-allocation decision-makers may make the wrong choice.



Another set of problems is related to the effects of growth after it occurs. Because the budget is a social contract, breaches of cost estimates can damage trust and relationships within government (Melese et al., 2007, p. 359). In some cases, they may breach legally imposed thresholds, the so-called Nunn-McCurdy breaches. When costs overrun, the remedy may involve stretching out schedules or reducing quantity, thereby reducing the new system's effect on the operating forces. The remedy may instead be a reallocation of funds away from a lower-priority program, thereby causing a different program's schedule or quantity to suffer. The remedy may also be a request for additional budget authority, imposing an opportunity cost for the nation as a whole.

The two most commonly proposed solutions to cost growth address the two sides of the problem that are most under governmental control: budget stability and cost-estimation accuracy. The former contends that increased funding stability would allow the program manager to shift attention to non-financial factors by insulating the program from the vagaries of politics and execution-year fiscal maneuvers. The GAO reported that over one-third of program managers said the biggest obstacle they faced was funding stability (GAO, 2005, p. 44). The latter contends that the problem originates with inaccurate cost estimates and that improved accuracy will contain cost growth. These reforms address the problem of unmet expectations by minimizing the *amount* of cost growth. In the process of doing so, they unfortunately fail to alleviate the *effects* of cost growth. In some cases, these reforms would introduce additional undesirable effects. This paper argues that instead of seeking to minimize relative cost growth, decision-makers should focus attention on minimizing total cost. Paradoxically, some of the very forces that hold total cost down are rooted in the dissatisfaction with cost growth.

## Capital Budgeting Reforms

Private industry—as well as many state and municipal governments—employs separate processes to budget for capital items and operating expenses. Most people in managing their household budgets do the same: we apply one form of decision logic when budgeting for the electric bill or groceries and a different logic when deciding to purchase a new car or major appliance. Within the DoD, procurement budgets are worked alongside operating and salary budgets, and both are appropriated on an annual line-item basis. Reformers have often questioned this practice. Most recently, the 2006 *Quadrennial Defense Review* and the *Defense Acquisition Performance Assessment* recommended a form of capital budgeting.

Capital budgeting involves the analysis of costs and cash flows associated with an investment project that precedes and informs the decision to invest. At most levels of government (excepting, notably, the federal government), capital investment decisions are made in tandem with the decision of how to finance them—most being paid for with revenue measures such as a special tax assessment or with debt instruments such as bond issuances or loans. There is a deliberate link between the investment and its implications for current and long-term budgets, fiscal policy, asset management, and cash flows (Lee & Johnson, 1998).

The budgeting practice for capital investments at the federal level has a different flavor. Federal capital budgets do not necessarily need to be separate from operating budgets in the absence of the balanced budget requirements common at the state and municipal level. The sovereign federal government may run deficits, raise revenues, print money, and borrow more readily than any other organization. Linking the capital purchase to a specific revenue stream is not necessary. Annual resource flows are often sufficient to fully fund the federal capital projects. Thus, they face the same annual review and trade-off decision-making as operating budget accounts.





Irrespective of the budgetary concern, federal capital projects are sometimes viewed as mechanisms for affecting macroeconomic conditions. Capital projects may be started, not because the ends of the project are the main objective, but because the job itself, the means to the end, is highly desirable. Programs during the Great Depression like the PWA, WPA and TVA were as much about creating jobs as they were about building bridges and dams. Urban renewal projects are more about sociological factors than buildings. Likewise, some capital investments in military systems are made in part to effect public objectives other than military capability. These short-term and complementary goals that are achieved through capital programs confound the analysis and argue against a separate capital budgeting strategy.

Private-sector capital budgeting practices are similar to those used in government and include lifecycle cost and benefit analyses. The costs include the obvious investment in the item, financing costs, and any incremental operating and support costs. Benefits include new revenue streams or lower operating and support costs. Investment decisions are based on one or more analytical techniques, such as payback period, net present value, or internal rate of return. These are benchmarked against a hurdle rate which represents the next best available use of the funds. Assuming the project will generate sufficient risk-adjusted return in a reasonable period of time, a capital budget is prepared. That budget is often distinct from, but affects, the organization's annual operating and support budget. The capital budget may be prepared outside the annual operating and support budget cycle, the timing more aligned with project schedules than accounting cycles. Funds to pay for the capital project also may be raised separately from the revenues raised by routine operations (but the service of debt, for example, would be incorporated into future operating budgets).

One significant problem with adapting capital budgeting for defense items is that there is no benefit that is easily defined in financial terms. Computation of a net present value or payback period is meaningless if the benefit and the cost cannot be expressed in consistent units.<sup>1</sup> There is no clear rate of return against which to compare to a hurdle rate. What can be done, however, is to perform a cost-effectiveness analysis for competing proposals that perform essentially the same task. Two alternative proposals for meeting the same need have presumably equal benefits and, therefore, can be compared based solely on a cost analysis. But comparison of capital budgets for items that generate disparate benefits is very problematic.

Acquisition reformers argue that best (or at least common) capital budgeting practices would provide much needed stability to the management of defense acquisition programs (Kadish et al., 2006; McCaffery & Jones, 2006). One form of the proposal is to separate the capital decision from the operating cost decision, to examine each capital decision when the program is ready, and to fund fully the development and acquisition costs at that time. It is argued that such a practice will increase the likelihood of program success by addressing a significant risk factor. The FY 2007 *Defense Acquisition Transformation Report to Congress* clearly shows that the DoD accepts this argument (Kreig, 2007, p. 20). Such proposals, however, involve risk. Indeed, secondary costs may outweigh the primary benefit.

Isolating the capital investment decision necessarily removes it from the larger discussion of overall defense policy and resource allocation. The legislature prefers to debate and decide defense matters once in the annual authorization and appropriation process. Separating the capital items may cause the same issues to be debated twice or may mask

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<sup>1</sup> Housel and Bell (2001) recognize this problem and suggest a methodology. Practical application of that methodology in the DoD is unlikely in the near term, if ever.

interrelationships that should be considered as a whole. Just as the DoD considers the full portfolio of options during the programming phase of PPBE, the legislature needs to do the same. By separating the capital items from the rest of the program during budgeting, decision-makers could eliminate that possibility. Given the legislature's constitutional power to raise and support armies and provide and maintain a navy, such proposals seem politically infeasible.

Separation of the capital investment decision also has little practical benefit. Under existing full-funding policies, the entire amount to build an end-item is presumably budgeted and appropriated. If prepared properly, the budget request should have considered the lifecycle cost and independent cost analyses. If Congress appropriates the full funding in multi-year appropriations, based on the President's Budget, then the goals of a capital budgeting process have already been met. Curiously, the trend in the DoD, at least in the Navy, has been to expand the use of incremental budgeting over full funding—a practice clearly at odds with the stated recommendation to adopt corporate-style capital budgeting practices.

Another form of capital budgeting reform proposes to fence procurement dollars once appropriated. The problem this proposal attempts to remedy is that funds too easily move out of procurement programs to address contingent needs elsewhere in the budget. In some cases, one procurement program which is experiencing problems is assisted with funds taken from another procurement program. In other cases, contingencies may affect the operating accounts, and without sufficient budgetary slack to address the contingency, funds are transferred from procurement programs. The recommendation to fence funds, however, is a budgeting reform to what is actually a problem of execution discipline. If the services are concerned that funds are taken from one program to address issues in another, then they should simply stop doing that. Addressing the problem of execution discipline is a more appropriate remedy than creating a new budgetary approach. Easier said than done, critics will say. So if this reallocation is inevitable, what are the effects of such fences?

Fenced accounts serve to make the resources allocated to procurement more important than dollars allocated to operations; or, to put it another way, future readiness would become *de facto* more important than current readiness. It would be short-sighted to institutionalize such a decision, as it actually restricts flexibility to deal with unforeseen contingencies. If the procurement accounts cannot be a source to deal with the contingency, what *is* the source? Pay accounts? Operations elsewhere around the globe? Such fences also tend to restrict funds flowing in *both* directions. Many an acquisition program has benefited from reprogramming actions in which funds are taken from operating accounts; separate capital accounts may restrict these flows. The *Mine Resistant Ambush Protected (MRAP)* vehicle program received over a billion dollars in FY 2007 that way. The current process is not perfect, but it may be better than inappropriately adopting a practice that is “best” in a different context.

To summarize, corporate and non-federal government models of capital budgeting do not adapt well to the federal government. While adoption of capital budgeting reforms would potentially stabilize the funding outlook for select acquisition programs, such actions inject rigidity into a process that demands flexibility in so many other areas. Fiscal law already imposes rigidity; the creation of special accounts for acquisition programs simply adds to that problem. Capital budgeting reforms are unlikely to be adopted if they limit broad analysis of the defense program and trade-offs within it. Nor will adoption be likely if reforms challenge the balance of power between the executive and legislative branches. Existing processes already encourage the employment of some capital budgeting analytical processes; the specific remedies proposed are unlikely to resolve the problems of cost management. Indeed, they may create new problems.



## Rational Cost Model Reforms

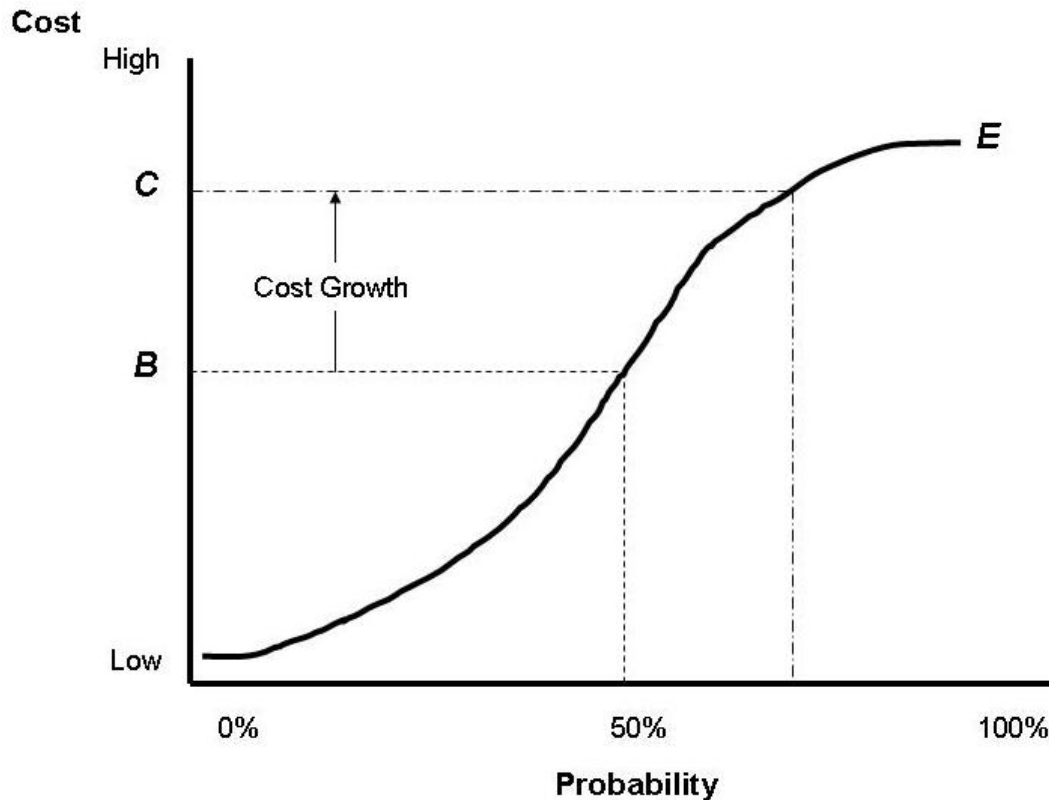
The second area of reform concerns the cost estimate on which the investment decision and budget are based. As the GAO recently stated, “If we expect programs to be executed within budget, programs need to begin with realistic budgets. The foundation of an executable budget is a realistic cost estimate that takes into account the true risk and uncertainty in a program” (GAO, 2007, p. 17). There is widespread dissatisfaction with the accuracy of defense cost estimating—both in Congress and within the DoD. When a program experiences cost growth above its budgeted amount, the allocation of funds in current or future-year budgets must be adjusted to keep the program on track; doing so requires either top-line relief or a decrease to one or more other program budgets. Either way, expectations are unmet. Before evaluating some of the proposed remedies to this problem, we must understand the nature of the problem.

Of course, one must acknowledge that the cost-growth problem involves three variables. First is the cost estimate ( $E$ ), which is often cited as a discrete figure, but in reality is a range of values defined by a probability distribution. Second is the amount budgeted ( $B$ ) for the program,<sup>2</sup> which is a discrete value selected presumably from somewhere along the cost-estimate probability curve. Third is the final cost of the program ( $C$ ), a discrete value. The public often scrutinizes the difference between  $B$  and  $C$ , as these are the figures that exist in budget or appropriation documents, contract audits, SAR reports, and the like. Scholars and management reformers tend to also focus on the relationship between  $E$  and  $B$ , but the nuances often fail to capture the public’s and politicians’ interest.

Shown graphically in Figure 1, a notional cost-estimate S-curve (so called because of its shape) will define a probability distribution based on the confidence of data populating the estimating model and the accuracy of the model itself ( $E$ ). There is little probability of the government meeting the cost estimate at the low-dollar-value end of the curve, but a very high probability of meeting program goals at the high-dollar-value end of the curve. During the budgeting process, a value is selected along the curve at the appropriate amount of funds—the precise point on the curve is the subject of some reform proposals and will be discussed shortly. For illustration purposes, the 50% probability value is shown ( $B$ ). Eventually, at program completion, one has a final cost, notionally shown on the chart at value  $C$ . Cost growth is generally considered the difference between  $B$  and  $C$ . Many definitions of cost growth select  $B$  at acquisition Milestone B and  $C$  at program completion (or latest estimate if still ongoing), and years may pass between the formulation of  $B$  and the eventuality of  $C$ .

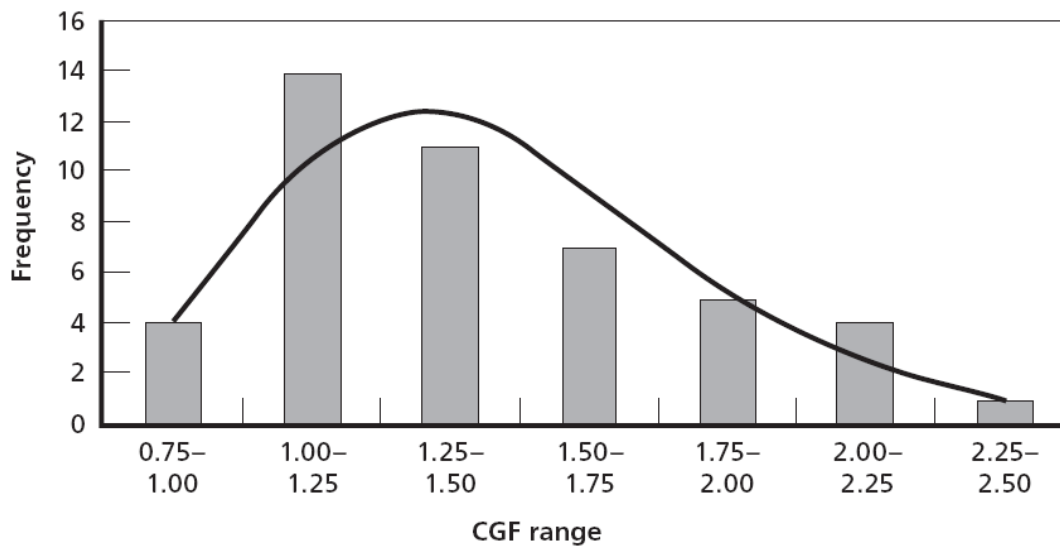
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<sup>2</sup> To be even more precise, one could break down this variable into the programmed amount, the budgeted amount, the appropriated amount, and the amount actually provided to the program office. Those distinctions, though often quite real, are not necessary to make here.



**Figure 1. Cost Growth Diagram**

It is important to first note that cost-estimating errors, when they exist, are overwhelmingly low compared to the cost estimate. This author has yet to read a study or hear a defense official or politician complain that cost estimates are too high and *overestimating* errors are a problem. While this may seem facetious, it is a critically important point. If cost-estimating errors were a function of poor-quality data or technically inaccurate models, then one would expect normally distributed errors with a mean near zero. What we see is more of a lognormal distribution with very few observations of overestimation—as in Figure 2, below, from a RAND study. This distribution suggests that there are biases in the data or models. Thankfully, biases can be found and eliminated. That is what much of the research and many of the recommendations in this area seek to do.



**Figure 2. Cost-growth Factors (CGF) of Major Acquisition Programs**  
(Arena, Leonard, Murry & Younossi, 2006, p. 22)

What are the biases that affect cost estimates? RAND cites the following causes for cost growth: “overoptimism, estimating errors, unrecognized technical issues, requirements creep, lack of incentives to control cost, and schedule extensions” (Younossi et al., 2007, p. xxi). While unrecognized technical issues may indicate a poor estimate, *unrecognizable* errors do not. Most cost-estimating models make allowances for the likely ones; the unknowable ones should be distributed randomly, as should errors. Schedule extensions and requirements creep may help explain why final costs are higher than the estimate; however, they are not estimating problems if the changes to schedules and requirements occur subsequent to the estimate, and the estimate correctly considered the original schedule and requirement. Further, it is incorrect to view cost growth as a problem in a situation in which requirements grow, and the cost of those requirements—had they been considered—would have been consistent with the estimate. In those cases, the item purchased is not the same as the item estimated.<sup>3</sup> And in many cases, schedule extensions are an effect, not a cause, of cost growth. These are matters of program management discipline, not cost-estimating accuracy. A lack of incentives to control costs is also a matter of program management or oversight and is not a matter of cost estimating, directly. It may be an indirect factor, as we shall see below. That leaves overoptimism as a source of non-normal bias in the estimate.

Melese and his co-authors blame two factors: “bad incentives (psychological and political-economic explanations) and bad estimation (methodological explanations)” (Melese et al., 2007, p. 359). Similarly, Flyvbjerg (2006) cites three categories of factors. One (technical estimating errors) he dismissed because of the non-normal distribution of errors and the general

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<sup>3</sup> It is important here to acknowledge that, politically, this distinction may not matter. The public at large does not hold that information and only sees that the latest fighter (or ship or other program) has grown in cost. It does not see that the airplane that was bought is better than the one estimated.

lack of improvement over time. The other two, optimism bias and strategic misrepresentation,<sup>4</sup> are characterized as psychological and political factors, respectively. Thus, all three studies identify similar biases, but they suggest different remedies.

The problem is that two types of bias exist in cost estimating: optimism and strategic misrepresentation. These biases affect the cost estimate, the amount budgeted for the program, or both. There are other forces that affect the final cost figure and manifest during the execution of the program: requirements creep (including the unforeseen technical issues), some schedule extensions, and incentive structures. Let us consider three proposed remedies to the cost-estimating problem in light of these biases and factors.

*DAPA Recommendation—budget higher on the curve.* To its credit, the *DAPA* report did not look solely at cost-estimating errors, but rather at the totality of issues affecting defense acquisition.<sup>5</sup> As part of its authors' comprehensive examination, recommendations were offered in several areas, including budgeting and cost control. Among those budgeting and cost control recommendations was the proposal to "Adjust program estimates to reflect 'high confidence'—defined as a program with an 80% chance of completing development at or below estimated cost" (Kadish et al., 2006, p. 13). Acknowledging the overoptimism and strategic misrepresentation biases in the system, which they refer to as "the conspiracy of hope" (p. 102), the authors assert that using optimistic estimates (defined as the 50% confidence level) results in excessive restructuring of budgets and programs. Essentially, the *DAPA* report suggests an appropriate level of funding: that *B* should be set at a specific, higher, point on the *E* curve.

There is an attractive logic to the *DAPA* proposal. If *B* were set higher on the *E* curve, one can be reasonably certain that the degree of cost growth would diminish. Presumably, only 1/5 of programs would risk cost growth, and 4/5 should cost approximately what was budgeted. This would reduce the need for budgetary and programmatic adjustments, as far fewer programs would experience growth problems. This proposal, however, results in higher overall spending for the same programs.

Federal appropriation law and the norms of the federal government are such that every dollar appropriated is expected to be spent. If a program is funded at the 50% probability level, there is an even chance it will either cost what was budgeted or will cost more. In other words, there is nearly a 100% chance it will cost *at least* the 50% level. By funding that same program at the 80% probability level, there is zero chance that it will cost the amount of the 50% or the 60% or the 75% estimate. There is a nearly 100% probability it will cost at least the 80% estimate. While funding at the higher level reduces the likelihood of cost growth, it does so by guaranteeing the higher cost in the first place. There is no longer the possibility of a negative effect on other programs; it is foreordained. Rather than risk the possibility of disrupting

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<sup>4</sup> Jones & Euske define strategic misrepresentation as "the planned, systematic distortion or misstatement of fact—lying—in response to incentives in the budget process" (1991, p. 437). This definition is consistent with Flyvbjerg's use of the term.

<sup>5</sup> The report warns that one should implement comprehensive change rather than incremental change. "Past practices are replete with examples demonstrating that if you adjust one part of the system with corrective measures, challenging issues surface in other parts of the system. When untested corrective action is taken, over time it can result in unintended consequences" (Kadish et al., 2006, p. 82). This author agrees wholeheartedly; in fact, the purpose of this report is to draw attention to those unintended consequences.



secondary programs or altering schedules and reducing quantities of the primary program, those changes necessarily occur at the outset.

*Melese et al. Recommendation—TCE.* In a study that looked specifically at cost-estimating accuracy, Melese and his colleagues employ transaction cost economics (TCE) theory to the problem of cost growth. While acknowledging the psychological and political biases that create bad incentives, they mainly focus on improving bad estimation methodologies. The authors suggest the use of TCE will obtain less biased estimates which, in turn, will reduce the mean and variance of cost growth. Noting that inaccurate estimates may result from omitting variables, the estimator is encouraged to consider costs beyond production to “include coordination and motivation costs such as search and information costs, decision and contracting costs, and monitoring and enforcement costs” (Melese et al., 2007, p. 359). After clearly describing factors within the DoD and their contractors that drive cost growth, the authors conclude that “cost estimating techniques must properly anticipate extra transaction costs [...] that can quickly overwhelm initial production cost estimates” (p. 365).

There are two concerns with this approach. First, “TCE predicts contracts and other governance structures will be chosen that reduce transaction costs and improve the gains from exchange between buyers and sellers” (p. 367). This is true only so far as both buyer and seller are motivated by a concern for economic efficiency. This is not necessarily true when one of the actors is a government. Rules governing competitive bidding, free trade, the use of small businesses, and *Buy-American* provisions all add transaction costs and often raise production costs. The public value in such rules is not economic; it is elsewhere in the complexion of values that define the public sector: values such as fairness, equity, accountability, or justice. The evidence is not at all clear that the DoD is motivated to design governance structures, for instance, that reduce transaction costs. The excessively bureaucratic structure of the acquisition review and approval processes is hardly designed to be efficient. Those processes are arguably designed to limit undesirable effects more than they are designed to encourage desirable ones.

Second, since acquisition cost growth is measured predominantly in production cost terms, the increases that are routinely experienced are in production costs; they are not caused by the omission of transaction costs. Cost growth is most commonly defined as increases in development and production costs as reported in *Selected Acquisition Reports*. In other words, those costs are the ones funded through RDT&E and procurement appropriations. The majority of the transaction costs, on the other hand, are funded in operations appropriations. Contracting, contract administration, auditing, data collection, oversight, etc., are neither included in the baseline nor in the final cost estimate.<sup>6</sup> The salary of the program manager is not even included. The omission of such costs does not account for the growth.

The value of a TCE approach comes from the knowledge that managing those activities may reduce cost growth, but including them in the estimate will not. Inclusion of those costs in the estimate would have the additional unintended consequence of ascribing an economic value to those activities above the other social values they were intended to create. Audits are done not to reduce cost but to provide accountability and assurance to the public. Governance

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<sup>6</sup> Volume 2A, Chapter 1 of the DoD Financial Management Regulations says: “The cost of civilian personnel compensation and other direct costs (i.e., travel, office equipment leasing, maintenance, printing and reproduction) incurred in support of procurement and/or production programs by departmental headquarters staff, contracting offices, contract audit offices, system project offices, and acquisition managers are expenses.” As expenses, they are not funded in the procurement accounts.

structures exist not only to hold economic costs down, but also to ensure against waste and fraud and to ensure compliance with the law. Many of those laws are motivated by social, not economic values. Because of that, decision-makers should focus not on minimizing their drain on the acquisition of weapon systems, but rather on reducing the cost of attaining that social goal irrespective of the weapons system.

Undoubtedly, a better understanding of the role transaction costs play in the motivation of sellers can assist in the negotiation and administration of contracts; that may, in turn, help lower the cost of production. But because many of those transaction costs serve non-economic goals, they should remain outside the cost estimate and the final cost tally.

*Flyvbjerg Recommendation—reference class forecasting.* There is another way to address the psychological and political biases other than using TCE. Flyvbjerg (2006) recommends using reference class forecasting—an estimating methodology based on Kahneman and Tversky's (1979) work in decision-making under conditions of uncertainty. Reference class forecasting addresses optimism and strategic misrepresentation biases by relying on the actual performance of a reference class of comparable projects. To combat the optimistic bias inherent in an "inside view" of the project, under reference class forecasting, those estimating the cost of a project assume an "outside view" by considering the experiences of comparable projects. In his study of public works projects, Flyvbjerg finds that different classes of projects improve their cost-estimating accuracy by apply various "uplifts" to the inside view estimates. He finds that to achieve the 80% probability level (the same probability the *DAPA* report recommends), estimates for road, bridge/tunnel, and rail projects should rise 32, 55 and 57%, respectively.

Reference class forecasting suffers from the same effect as the *DAPA* recommendation: improvements in cost-estimating accuracy are achieved by forfeiting the possibility of lower total costs. Reference class forecasting is not a new idea for defense acquisition. The "outside view" was the motivation for the creation of the Cost Analysis Improvement Group in 1972 and the requirement for independent cost estimates (Melese et al., 2007). The Congressional Budget Office employs this basic concept in their report series *Long-term Implications of Current Defense Plans* (CBO, 2007). The knowledge exists. One could even assume it is considered by decision-makers; it simply is not used. The important question is why not?

All three studies suggest remedies to improve the accuracy of cost estimates and to lower the likelihood of cost growth in defense acquisition. They each acknowledge that cost growth is less a technical estimating problem as it is a problem of psychological and political bias. The three recommendations would all bring *B* closer to *C* on Figure 1 and would be able to claim gains in cost-estimating accuracy. This paper concedes that such methods are likely to reduce cost growth, but it also warns that they do little to address the ultimate problem of total cost. In fact, all three recommendations would aggravate rather than mitigate the ultimate problem: high costs crowding out other spending and their effect on military force structure. Why? Because all three methods program those costs with certainty rather than risk the possibility of them occurring later.

One should notice that all three methods suggest that the DoD more fully consider costs known to exist. I submit that those costs are considered and intentionally dismissed for one of two reasons. One reason—acknowledged by Melese et al. and Flyvbjerg—is that a lower estimate may be politically necessary to achieve the "camel's nose in the tent" effect. Wildavsky (1979) suggested that low initial budget estimates, while inaccurate, serve a useful purpose by getting a program initiated. Then, once it is initiated, upward adjustments are easier to obtain in





the future than approval of the program at the higher amount in the first place. Strategic misrepresentation (Flyvbjerg, 2006; Jones & Euske, 1991) is a common occurrence and one not undertaken lightly. Those engaging in strategic misrepresentation weigh the benefit of a higher probability of program initiation against the higher probability of a cost to one's reputation and the inevitable downstream budget pressure. Evidently, in some cases, the balance tips in the favor of under-representing cost.

Another reason for underestimating is that the Defense Department may be wittingly or unwittingly engaging in target costing (Monden & Hamada, 1991; Cooper & Slagmulder, 1997). Target costing is the practice of intentionally setting aggressive financial targets as an inducement to achieve those targets. It is done with full knowledge that there is a risk of cost growth, but that risk is accepted in exchange for the possibility of hitting the lower actual cost. Costs are managed through value engineering programs. The Navy's recent goal of producing a Virginia class submarine for \$2 billion is an example. Target costing is the opposite of what the three studies recommend. Target costing can be effective if the environment is such that: (a) program managers are not punished for missing cost goals if their actual performance is reasonable, and (b) resources are slack enough to cover the inevitable cost growth. Both conditions tend to exist in the DoD.

Whether the reason for perpetuating low estimates is an example of the camel's nose theory or target costing, such low estimates are of value to the DoD. In the first case, a desired but politically risky program is begun and, once begun, is likely to perpetuate. In the second case, pressures are applied to programs to hold costs down, and the possibility of actually hitting those ambitious targets is left open. The two reasons may co-exist: through ambitiously low estimates, sufficient resources are apparently made available to initiate a new program. In some cases, this is evidently preferable to raising the estimate of the first program to reduce the likelihood of cost growth and, consequently, to eliminating the possibility of initiating the second.

Paradoxically, it is the dissatisfaction with cost growth that permits practices like target costing to work, and it is the dissatisfaction with cost growth that limits the use of strategic misrepresentation. Funding at a low level of probability can be revisited during the annual budget cycle, but in the presence of constrained resources and dissatisfaction with cost growth, program managers are pressured to hit those ambitious targets and minimize growth. These existing practices likely hold total costs lower than would be the case if the recommendations were adopted. Why? Those recommendations relieve the pressure to contain cost growth but do so in exchange for nothing other than the satisfaction of having met the estimate. Defense behavior has shown that two programs bursting at the budget seams is preferable to one program managed comfortably.

## Conclusion

Dissatisfaction with cost growth has generated a set of recommendations designed to eliminate that growth. Unfortunately, adopting an inappropriate or unnecessary model may not be helpful; rigidity is not helpful when flexibility is needed, and foreordaining higher costs is not helpful. The dissatisfaction itself is helpful.

Recall that the main concern with cost growth is that it affects the total defense program. Systems are delivered later or in smaller quantities than expected. Root causes of the growth are psychological and political biases that manifest in the behavior of programmers, program managers, budgeters, contractors and politicians. These biases exist for a reason, and accounting for them does not make them disappear. Accounting for them simply makes explicit



what many actors in the system know implicitly. Failing to account for them serves to add pressure and incentives to the system, which may result in holding costs lower than they would be if the biases were accounted for.

The underlying concern should be spending in total—not spending relative to an estimate. However, defense leaders and stakeholders should not be complacent about growth because their dissatisfaction serves a useful purpose. Rather than eliminate that dissatisfaction, it should be understood for the role it plays. Indeed, the present state may very well have evolved—not unlike Darwin’s finches—to achieve a satisfactory balance among all the forces at play: in this case, economic, psychological and political ones.

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## 2003 - 2008 Sponsored Research Topics

### **Acquisition Management**

- Software Requirements for OA
- Managing Services Supply Chain
- Acquiring Combat Capability via Public-Private Partnerships (PPPs)
- Knowledge Value Added (KVA) + Real Options (RO) Applied to Shipyard Planning Processes
- Portfolio Optimization via KVA + RO
- MOSA Contracting Implications
- Strategy for Defense Acquisition Research
- Spiral Development
- BCA: Contractor vs. Organic Growth

### **Contract Management**

- USAF IT Commodity Council
- Contractors in 21st Century Combat Zone
- Joint Contingency Contracting
- Navy Contract Writing Guide
- Commodity Sourcing Strategies
- Past Performance in Source Selection
- USMC Contingency Contracting
- Transforming DoD Contract Closeout
- Model for Optimizing Contingency Contracting Planning and Execution

### **Financial Management**

- PPPs and Government Financing
- Energy Saving Contracts/DoD Mobile Assets
- Capital Budgeting for DoD
- Financing DoD Budget via PPPs
- ROI of Information Warfare Systems
- Acquisitions via leasing: MPS case
- Special Termination Liability in MDAPs



## **Human Resources**

- Learning Management Systems
- Tuition Assistance
- Retention
- Indefinite Reenlistment
- Individual Augmentation

## **Logistics Management**

- R-TOC Aegis Microwave Power Tubes
- Privatization-NOSL/NAWCI
- Army LOG MOD
- PBL (4)
- Contractors Supporting Military Operations
- RFID (4)
- Strategic Sourcing
- ASDS Product Support Analysis
- Analysis of LAV Depot Maintenance
- Diffusion/Variability on Vendor Performance Evaluation
- Optimizing CIWS Lifecycle Support (LCS)

## **Program Management**

- Building Collaborative Capacity
- Knowledge, Responsibilities and Decision Rights in MDAPs
- KVA Applied to Aegis and SSDS
- Business Process Reengineering (BPR) for LCS Mission Module Acquisition
- Terminating Your Own Program
- Collaborative IT Tools Leveraging Competence

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## Acquisition Research Program: Creating Synergy for Informed Change

### Panel 12: Budgeting & Acquisition Reform

#### Chair

Hon. Douglas Brook, PhD, Assistant Secretary of the Navy (Financial Management & Comptroller)

#### Discussants

RDML Charles Goddard, Program Executive Officer, Ships

Ms. Wendy Kunc, Director, Naval Center for Cost Analysis

#### Presenter

Philip Candreva, NPS Faculty & Center for Defense Management Reform



*“If we expect programs to be executed within budget, programs need to begin with realistic budgets. The foundation of an executable budget is a realistic cost estimate that takes into account the true risk and uncertainty in a program.”*

- GAO







## Acquisition Research Program: Creating Synergy for Informed Change

# Rethinking Acquisition Reform: Cost Growth Solutions may Aggravate More Important Problems

Philip J. Candreva

Senior Lecturer of Budgeting

Acting Director, Center for Defense Management Reform

Naval Postgraduate School

# The Problem with Cost Growth

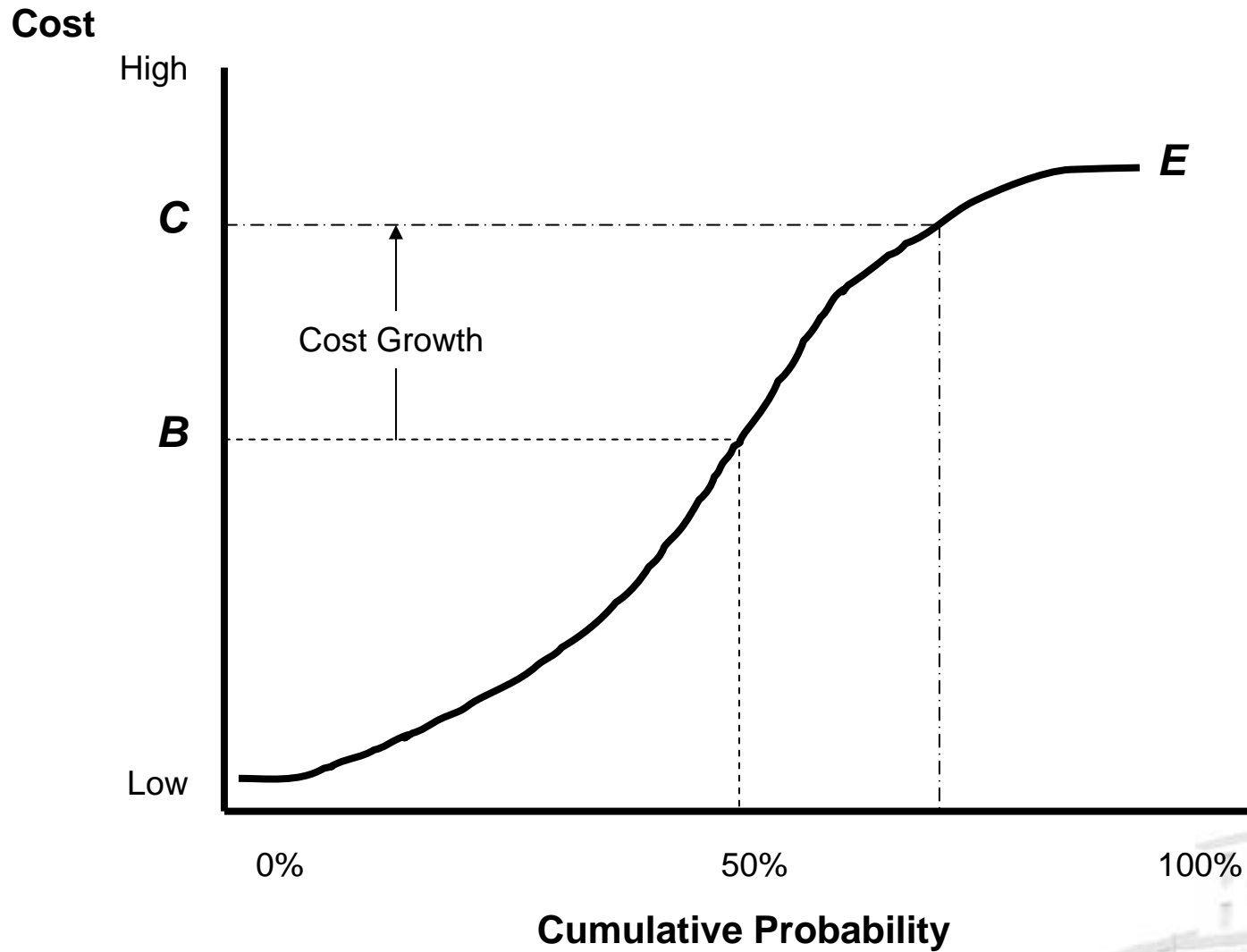
- Stresses the remainder of defense program
- Missed expectations by stakeholders
  - Top line must increase *or*
  - Schedules slip *or*
  - Quantities are reduced *or*
  - Capability is compromised *or*
  - Some combination of the above



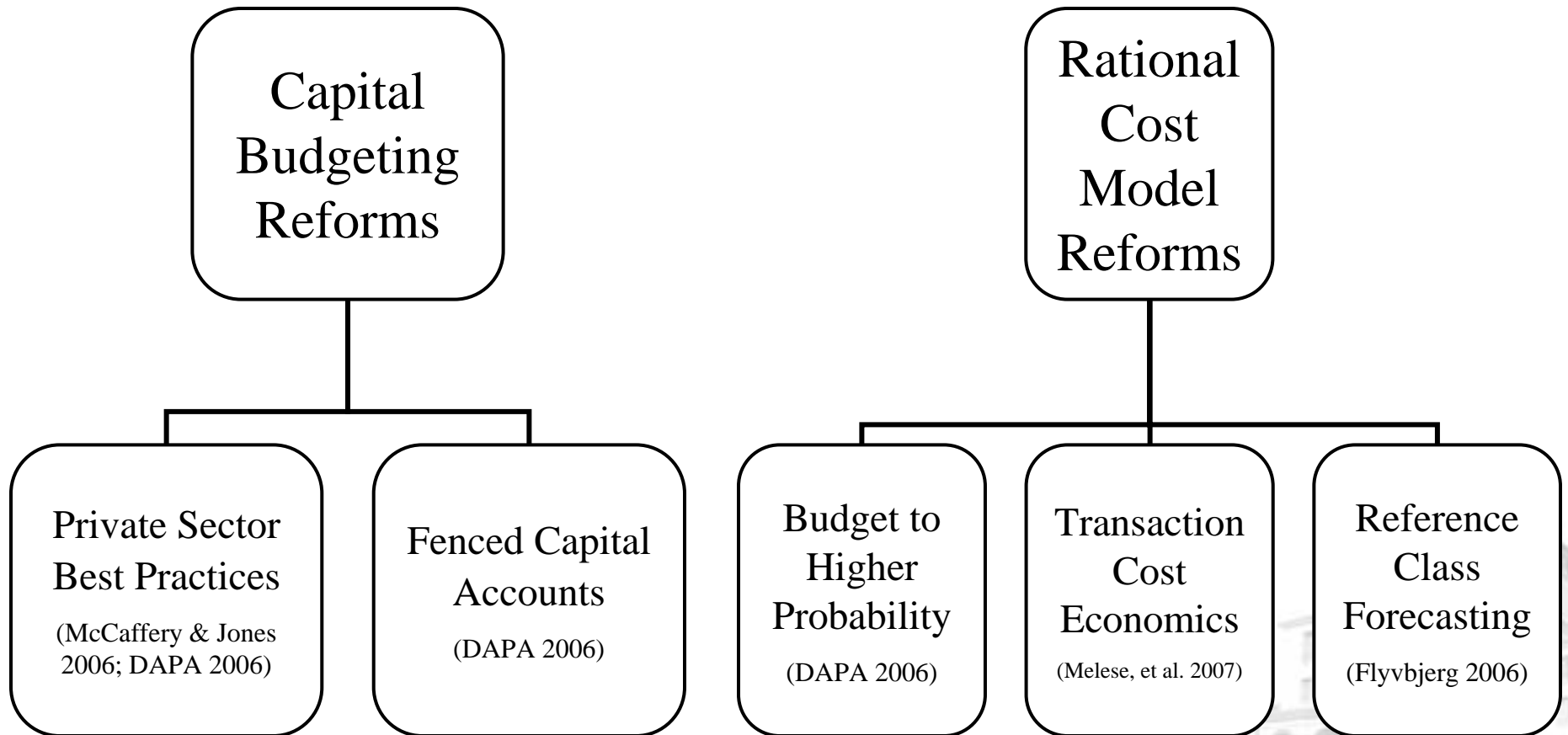
# The Nature of Cost Growth

- Historical, Current and Prospective Problem
- Well-studied and understood
- A focus of policy-maker, executive, and local management attention
- A relationship between three variables
  - The cost estimate ( $E$ )
  - The resourced / budgeted amount ( $B$ )
  - The final cost tally (or latest projection) ( $C$ )
- A positive number





# Two Categories of Reform



# Capital Budgeting Reforms

## Private Sector Best Practices

What? Separate capital investment decision from operating budget decision; do not revisit; use NPV, ROI, IRR

So? Appropriateness to federal government, limits portfolio approach, budget as control, definitional problems

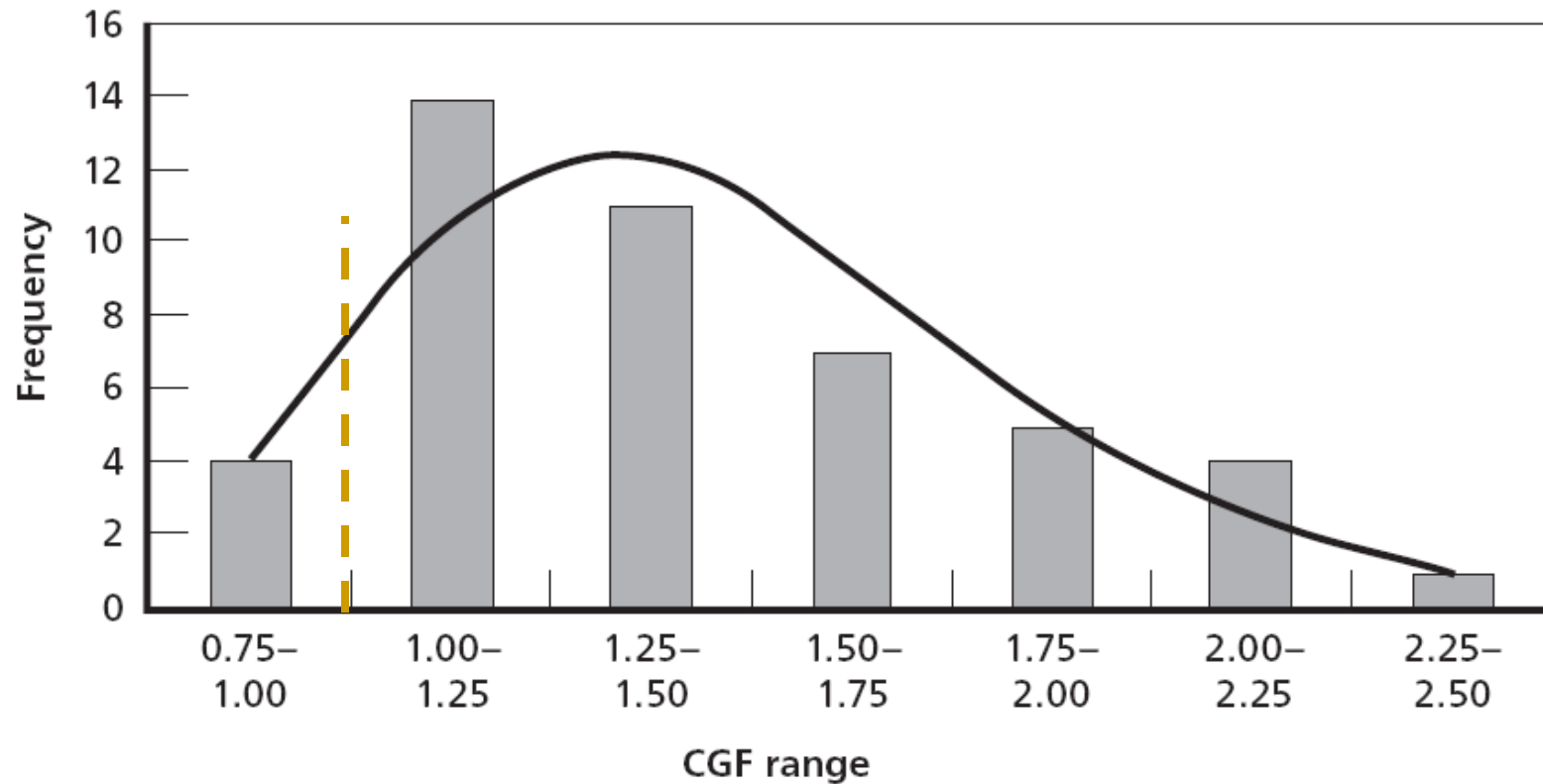
## Fenced Capital Accounts

What? Once appropriated, fence program dollars to provide stability

So? Budgetary remedy for execution discipline problem, de facto shift in priority, be careful what you ask for



# Cost Growth is (not statistically) normal



Source: RAND





# Potential Biases

Estimating Errors	Unlikely – errors are non-normal and not improving
Unrecognized technical issues	Also non-normal
Requirements creep or schedule slip	Program execution discipline matter. Schedule: cause or effect?
Lack of incentives to control cost and schedule	A moderating factor, not a source or cause
Political considerations	A potential bias
Over-optimism (Lake Wobegon)	A potential bias
Strategic misrepresentation	Evidence of the political consideration





# Rational Cost Model Reforms

## Budget to Higher Probability

What? Move B to the right on Cumulative Probability curve

So? Foreordains higher cost

## Transaction Cost Economics

What? Consider transaction cost of changes

So? Tangential issue for both cost and policy reasons

## Reference Class Forecasting

What? Base estimate on past performance of reference class

So? Already do that, but tend to ignore the information



# Bias has benefits

## Camel's Nose in the Tent

Program acceptance and initiation at a realistic estimate is more difficult to obtain than an upward adjustment of an existing program

## Target Costing

Using aggressive targets and value engineering efforts in an attempt to reduce cost below original estimates



# Critical Thoughts on Cost Growth

- Not so much a technical matter as a psychological or political one
- Absolute costs or relative costs? Dissatisfaction with cost *growth* serves to limit *total* costs
- Is cost growth the problem or the *effects* of cost growth?
  - Effect 1 – impacts on other programs – reforms may aggravate this
  - Effect 2 – missed expectations – already being considered
- About expectations... future research should explore balancing expectations between those held by political leadership and those held by industry

